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The Development of Attention Skills Among Children With Autism In Jordan Using Of Numbers And Letters In Arabic Language (NLAL) Applications In iPad And PowerPoint

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ABSTRACT

This research was focused to study the development of attention skills among children with autism in Jordan using of numbers and letters in Arabic language (NLAL) applications in iPad and PowerPoint. The objective of this research was to investigate whether there is a development in (attention skills, orienting attention, sustaining attention, shifting attention, and joint attention) among children with autism in Jordan due to the using of NLAL apps in iPad and NLAL in PowerPoint presentations. In addition to investigate whether there is a difference in the development in (attention skills, orienting attention, sustaining attention, shifting attention, and joint attention) among children with autism in Jordan based on their age due to the using of NLAL apps in iPad and NLAL in PowerPoint presentations Also, the research studied whether there is a relationship between the development of (attention skills, orienting attention, sustaining attention, shifting attention, and joint attention) among children with autism in Jordan and their age group due to the using of NLAL apps in iPad and NLAL in PowerPoint presentations. This research employed a quasi-experimental approach. The sample of this research consists of 30 children with autism (25 males and 5 females), aged between 3 and 13 years old. The research used test for attention skills. Independent sample t-test, gain score, one-way ANOVA, and partial correlation were used in this research to analyze the data from pretest, posttest. In general, the findings from this research shows that using of NLAL in iPad applications and in PowerPoint presentations developed attention skills in general and even orienting attention, sustaining attention, shifting attention, and joint attention among children with autism in Jordan.

INTRODUCTION

Autism is one of the most mysterious developmental disabilities because of the difficulty in determining its causes as well as its strange patterns of unadaptive behavior. This developmental disability is an ambiguous disorder with symptoms overlapping with other disorders and disabilities. The classification of this disorder since its discovery until today reflects the multiple and variable interests of past researchers. The types of autism include the Retts disorder, the childhood disintegrative disorder (CDD), the Asperger disorder, the autism spectrum disorder (ASD), and the pervasive developmental disorder, not otherwise specified (PDD-NOS) (Hansen & Rogers, 2013; Sapp, 2008; Wahlberg, Rotatori, Deisinger & Burkhardt, 2003).

In 1977, the World Health Organization classified autism as a diagnostic category, and the American Psychological Association (APA) in 1980 considered it as a comprehensive developmental disorder (Dietert, Dietert & DeWitt, 2011; Khateeb *et al.*, 2007). Autism affects the social, linguistic, and behavioral aspects of

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one's childhood. Various definitions have been introduced to explain this disorder. Autism has been described as a disorder in speed or sequence of growth, in the response stimulus, in speech, language, capacity of knowledge, and in the attachment and belongingness to people, events, and topics. These symptoms normally appear in a child before his/her 30th month. The parents and clinicians who work with children with autism know that the attention of these children is atypical and may affect the triad of the core features of such disorder, namely, communication deficits, impairments in social relatedness, and restricted and repetitive behaviors and interests (Kaale, Smith & Sponheim, 2012; Patten & Waston, 2011).

Considering the continuous advancements in technology, many studies have emphasized the importance and benefits in using assistive technology (AT) on children with disabilities, such as computer-based interventions (CBIs), computerized games, and other advanced technological devices and software. The latest technology is the iPad. Since its invention and introduction in the market, a number of studies have discussed how iPad can help children with disabilities in general and children with ASD in particular (Beaumont & Sofronoff, 2008; Douglas, Wojcik, & Thompson, 2012; Florou *et al.*, 2009; Goldsmith & LeBlanc 2004; Kay, 2012; McClanahan, Williams, Kennedy, & Tate, 2012; Newton & Dell, 2011; O'Malley *et al.*, 2013; Purdue Research Foundation, 2013; Rahman, Ferdous, Ahmed, & Anwar, 2011; Ramdoss *et al.*, 2011; Saylor & Rodriguez-Gil, 2012; Siegle, 2013; Veenstra, 2011).

This research aimed to determine the use of numbers and letters in Arabic language (NLAL) applications in iPad and PowerPoint in development of attention skills (AS) among children with autism in Jordan. NLAL was used to describe the application "Numbers and Letters in Arabic Language" in both platforms iPad and PowerPoint presentations using a laptop.

1.1 Problem of the Study:

The American Psychiatric Association (2000) indicated that the children with ASD exhibit three different aspects: (i) impairment in social skill deficits; (ii) impairment in verbal and communication skills; and (iii) restrictive, repetitive, and stereotyped patterns of behavior, interests, and activities (Moss & Howlin, 2009; Mukuria & Obiakor, 2008). These children also exhibit a number of distinguished characteristics; they suffer from memory problems and disturbance in attention, hyperactivity, rapid dispersion, and loss of interest in missions shortly after their engagement (Moss & Howlin, 2009). In addition, numerous children with ASD encounter problems with regard to their cognitive and knowledge skills and display repeated behavioral and cognitive patterns (Khateeb *et al.*, 2007; Low Hui Min & Lee Lay Wah, 2011).

Martins and Harris (2006), Patten and Waston (2011), and Riby, Brown, Jones, and Hanley (2012) examined the characteristics of AS among children who suffer from ASD and looked into how their AS can be improved with the help of teachers considering the importance of attention in learning, social responsiveness, and communication. These researchers particularly focused on the orienting, sustaining, shifting, and joint attentions of the children. Orienting attention refers to the initial physical adjustment toward a stimulus. Sustaining attention is one's ability to maintain his/her attention over an extended period of time. Shifting attention pertains to the case in which an individual disengage from one stimulus and then shift and reorient to a new stimulus. Finally, joint attention is the shared attention between two individuals and an object or another individual.

Most children with ASD have attention problems such as inability to follow head turn, eye gaze, and pointing; difficulty to fixate on a particular stimulus while ignoring other stimuli; inability to disengage from one stimulus and then shift their attention to a new stimulus; deficit in their ability to use joint attention gestures to engage other people to share their attention to an object; and inability to respond to their names. Most instruments that screen for ASD have included a test for screening AS given the increasing number of children who have problems with regard to their AS (Brereton, 2010; Jiang, Capistrano, Esler, & Swallow, 2013; Kaale, Smith, & Sponheim, 2012; Lawton & Kasari, 2012; Martins & Harris, 2006; Murray *et al.*, 2008; Patten & Waston, 2011; Riby, Brown, Jones, & Hanley, 2012; Schietecatte, Roeyers, & Warreyn, 2012).

The importance of including AS in the programs for children with ASD has been reported. Many other studies support the use of AT, which includes computer, computer software (PowerPoint presentations), computerized games, and tablet computers (i.e., iPad technology and its applications), to improve the skills of children with ASD, such as their attention, communication, and social skills (Aronin & Floyd, 2013; Beaumont & Sofronoff, 2008; Blood, Johnson, Ridenour, Simmons, & Crouch, 2011; Coleman, 2009; Conn, 2012; Douglas, Wojcik, & Thompson, 2012; Giannopulu & Pradel, 2010; Gulchak, 2008; Kay, 2012; Malley, Lewis, & Donehower, 2013; McClanahan, Williams, Kennedy, & Tate, 2012; Price, Howard, & Winslow, 2011; Rahman, Ferdous, Ahmed, & Anwar, 2011; Saylor & Rodriguez-Gil, 2012; Sahin & Cimen, 2011; Shah, 2011; Siegle, 2013; Staley, 2012; Stromer, Kimball, Kinney & Taylor, 2006; Tanaka *et al.*, 2010; Wu *et al.*, 2007). Numerous studies have proven that the use of computers positively affects AS. Reynolds and Baker (as cited in Rajabi & Ketabi, 2012) mentioned that presenting lessons and educational materials through computers can increase the attention and learning of the students; when the students' attention is increased, their learning is increased as well. Using such advanced programs is compatible with the learning style of children with ASD given that they are visual learners (Aliee, Jomhari, Rezaei, & Alias, 2013; Fan, 2012).

Swettenham (as cited in Durkin, 2010) presented three main reasons why children with ASD are attracted to computers. First, computers do not involve any social factors. Second, computers are consistent and predictable. Third, computers allow children to take active control and determine the pace of their chosen activity. Nonetheless, the iPad has more advantages than computers because it features touch screen actions, which are easier than using a keyboard or mouse, and has a number of free and low-cost apps. Thus, some studies have confirmed that an educational iPad game can increase the sustained attention of children with ASD; the attention span of these children is sustained when they interact with the iPad for a long period of time (Huang, Clark & Wedel, 2013; Ogura, Coco, & Bulat, 2007; Pelangka, 2011). Moreover, Fan (2012) mentioned that the majority of the children with ASD are visual learners and that the teaching methods of teachers and the learning styles of students (preferences for learning) should be compatible because they may affect the motivation, lifelong learning patterns, and academic performance levels of the children. In addition, using such advanced programs is compatible with the learning style of children with ASD given that they are visual learners.

Despite the growing interest on and the programs offered to children with ASD in Jordan, the education, training, and rehabilitation for these children in public and private schools continue to focus on traditional teaching methods, which are based on the use of simple means and teachers' methods (AL Jabery & Zumberg, 2008). Some studies have emphasized the importance and benefits of using AT, including PowerPoint and iPad applications (Douglas, Wojcik, & Thompson, 2012; Huang, Clark, & Wedel, 2013; Kay, 2012; McClanahan, Williams, Kennedy, & Tate, 2012; O'Malley *et al.*, 2013; Pelangka, 2011). However, these techniques are yet to be used in Jordan to formally train and rehabilitate children with ASD.

Hamza Al Shoura and Aznan Che Ahmad (2014) highlighted the need to set up information technology (IT) centers in Jordan to design AT, technical aides, and instructional strategies to meet the different needs of disabled children in line with the current orientations of the development of education technology strategy for all students in the country. All the previous findings about the use of AT in Jordan were supported by Mayada, Hatem, and Khalid (2008). These researchers specified that the special education teachers at schools in Amman, Jordan insufficiently use educational programs (i.e., Word, PowerPoint, graphic related programs, and educational games) and information and communication technology (ICT). Moreover, the use of AT is new and extremely limited in Jordan given the difficulty in accessing the internet and the lack of educational programs and devices for students with special needs.

The current study is seeking to answer the following questions:

1. Is there a development in attention skills, (orienting attention, sustaining attention, shifting attention, and joint attention) among children with autism in Jordan due to the using of NLAL applications in iPad and in PowerPoint presentations?
2. Is there a difference in the development in attention skills, (orienting attention, sustaining attention, shifting attention, and joint attention) among children with autism in Jordan based on their age due to the using of NLAL applications in iPad and in PowerPoint presentations?
3. Is there a relationship between the development of attention skills, (orienting attention, sustaining attention, shifting attention, and joint attention) among children with autism in Jordan and their age group due to the using of NLAL applications in iPad and in PowerPoint presentations?

1.2 Significance of the Study:

The significance of this research is derived from the importance of the following issues: children with ASD, the AS in general, the four aspects of AS (i.e., orienting, sustaining, shifting, and joint attention), and the use of AT, including iPad applications and PowerPoint presentations. This research enriches the theoretical frameworks for children with ASD and the use of NLAL applications on the iPad and PowerPoint in the development of the AS of children with autism in Jordan. This research is the first to look into the use of iPad applications and PowerPoint presentations among children with ASD in Jordan.

2. Methodology:

This research adopted quantitative approaches to achieve its goals. For the quantitative approach, a test for AS was developed based on the literature review and was applied to the respondents. The research population was composed of children with ASD enrolled in the Autism Academy of Jordan, a private center for special education in the Jordanian capital, Amman. This center has a total of 90 children aged 2 to 18 years old. 67 children aged 3 to 13 years old who have ASD in addition to other disabilities. The children in this center have different types of disability: ASD, mental retardation, multiple disabilities, and developmental delay; some of them have rare syndromes. However, only children with ASD were included in this research.

For the quantitative data, the research sample involved 30 children aged 3 to 13 years with ASD in Jordan (25 males and 5 females). The respondents were selected through non-random sampling (purposive sampling technique). The age of the children was divided into three categories: less than 6 years (11 children), 6–9 years (11 children), and more than 9 years (8 children). The respondents were divided into two groups. G1 consisted of 15 children with 13 males and 2 females. Similarly, G2 comprised 15 children with 12 males and 3 females.

2.1 Research Instruments:

2.1.1 Test for attention skills:

The researcher created a checklist for observing the AS of children with ASD. The test for AS is given in Appendix A. The checklist was developed based on the literature review, particularly regarding the characteristics of AS for children with autism. The validity, reliability, and the measures of the AS test were considered and verified before it was distributed to the respondents. The language of the checklist was first written in English, was translated into Arabic, and was re-translated again into English (i.e., back-to-back translation) to guarantee the same meaning in both languages.

The AS checklist features the four categories of AS: orienting, sustaining, shifting, and joint attention. Every category contains a number of related items. The examiner had to check the presence or absence of adjectives in every category using a rating scale that starts from 1 to 4, in which "1" implies that the child never showed the feature, "2" denotes that the child sometimes show the feature, "3" represents that the child often shows the feature, and "4" entails that the child always shows the feature. The first category is about orienting attention and includes eight items; the second category is about sustaining attention and contains 11 items; the third category is about shifting attention that covers eight items; and the fourth category is about joint attention that includes seven items.

Table 1: Test of Attention Skills Contents

Category	Number of items Related	Mark Minimum	Mark Maximum
1 Orienting Attention	8	8	32
2 Sustaining Attention	11	11	44
3 Shifting Attention	7	7	28
4 Joint Attention	7	7	28
5 Total	33	33	132

Validity was established through content validity, the instrument was standardized on the response of a experts group (n=4) in Educational faculty at Universiti Sains Malaysia and the University of Jordan. Raters gave their comments on the scale. Meanwhile, reliability of the instrument was determined through the test-retest reliability; sample of 30 respondents from of the study population. The results were as follows:

Table 2: Pearson Correlation Results for Test of Attention Skills

Variable	(r)**
Orienting Attention	0.675
Sustaining Attention	0.791
Shifting Attention	0.831
Joint Attention	0.961
Total Scale	0.834

**Correlation is significant at the 0.01 level (2-tailed).

Table 2 illustrates that the Pearson correlation test for each of the items in the AS test reflects a significant relationship and high internal consistency.

2.1.2 iPad Applications and PowerPoint Presentations:

The researcher chose two applications from the App store. The first application was about numbers in Arabic language, including numbers from 1 to 10. The second application was about letters in Arabic language; Arabic Letters and Words for iPad. This application contained 28 letters and pictures of things whose names start with each letter. These applications were used for G1, which included 15 children. For the control group G2 that comprised 15 children, the researcher used two PowerPoint presentations developed to be similar to the content of the iPad applications (i.e., colors, motions, pictures, and sounds). The PowerPoint presentations were designed by an IT specialist who was thoroughly briefed about the requirements in making the presentations. The first PowerPoint presentation was about numbers in the Arabic language, which included numbers 1–10. The second presentation was about letters (a total of 28 letters) in Arabic.



Fig. 1: iPad Application for letters in Arabic language



Fig. 2: PowerPoint presentations for letters in Arabic language

3. Results:

To answer the research question one, “Is there a development in attention skills, (orienting attention, sustaining attention, shifting attention, and joint attention) among children with autism in Jordan due to the using of NLAL applications in iPad and in PowerPoint presentations?”, the teachers facilitated the AS test to G1 and G2 before and after the use of iPad applications and PowerPoint presentations. The test was conducted using the independent sample t-test. The researcher compared the means between the results of the pre- and post-tests for every group’s AS, particularly regarding their orienting, sustaining, shifting, and joint attention.

Table 3: Means, Standard Deviations, and t-test of results for Pretest and Posttest of the iPad Group in Attention Skills

Group	N	Mean	Std. Deviation	Std. Error Mean	t	Sig. (2-tailed)	
1	Posttest	15	3.9000	.19594	.05059	24.435**	.000
	Pretest	15	2.0417	.21992	.05678		
2	Posttest	15	3.6242	.35851	.09257	17.136**	.000
	Pretest	15	1.6848	.25218	.06511		
3	Posttest	15	3.7048	.18284	.04721	23.943**	.000
	Pretest	15	1.6381	.27987	.07226		
4	Posttest	15	3.9429	.15080	.03894	31.849**	.000
	Pretest	15	1.8952	.19814	.05116		
Total	Posttest	15	3.7758	.20705	.05346	26.503**	.000
	Pretest	15	1.8061	.19996	.05163		

**Significant at 0.01 level

The results showed that the t-values for these variables are significant at 0.01 level, implying that each variable between the pre- and post-tests significantly varies and that these differences tend to increase in the post-test rather than in the pre-test.

Table 4: Means, Standard Deviations, and t-test of results for Pretest and Posttest of the PowerPoint Presentations Group in Attention Skills

	Group	N	Mean	Std. Deviation	Std. Error Mean	t	Sig. (2-tailed)
1	Posttest	15	3.4250	.78177	.20185	6.871**	.000
	Pretest	15	1.9000	.35732	.09226		
2	Posttest	15	3.0545	.81659	.21084	6.593**	.000
	Pretest	15	1.5515	.33573	.08668		
3	Posttest	15	3.1238	.85692	.22125	6.672**	.000
	Pretest	15	1.5905	.24067	.06214		
4	Posttest	15	3.3619	.93032	.24021	6.374**	.000
	Pretest	15	1.7905	.21508	.05553		
Total	Posttest	15	3.2242	.83058	.21445	6.789**	.000
	Pretest	15	1.6949	.26701	.06894		

**Significant at 0.01 level

The results showed that the t-values for these variables are significant at 0.01 level, signifying that each variable between the pre- and post-tests significantly varies and that these differences tend to increase in the post-test than in the pre-test.

Table 5: Means, Standard Deviations, and t-test results for Pretest of the Two Groups in attention skills

	Group	N	Mean	Std. Deviation	t	Sig. (2-tailed)
1	iPad	15	2.0417	.21992	1.308	0.202
	PowerPoint	15	1.9000	.35732		
2	iPad	15	1.6848	.25218	1.230	0.229
	PowerPoint	15	1.5515	.33573		
3	iPad	15	1.6381	.27987	0.50	0.621
	PowerPoint	15	1.5905	.24067		
4	iPad	15	1.8952	.19814	1.387	0.176
	PowerPoint	15	1.7905	.21508		
Total	iPad	15	1.8061	.19996	1.290	0.208
	PowerPoint	15	1.6949	.26701		

The independent sample t-test was used to compare the means between the two unrelated groups. The calculated the t-values for these variables are not significant at 0.05 level. In particular, the AS in general and its four categories of the children involved in G1 and G2 insignificantly vary. Both groups are equal and insignificantly vary in terms of their AS, including its four categories. This condition implies that changes were observed in the post-test between the groups because of the use of the iPad applications or PowerPoint presentations.

Table 6: Means, Standard Deviations, and t-test results for Posttest of the Two Groups in attention skills

	Group	N	Mean	Std. Deviation	t	Sig. (2-tailed)
1	iPad	15	3.9000	.19594	2.283	0.037
	PowerPoint	15	3.4250	.78177		
2	iPad	15	3.6242	.35851	2.474	0.023
	PowerPoint	15	3.0545	.81659		
3	iPad	15	3.7048	.18284	2.568	0.021
	PowerPoint	15	3.1238	.85692		
4	iPad	15	3.9429	.15080	2.387	0.031
	PowerPoint	15	3.3619	.93032		
Total	iPad	15	3.7758	.20705	2.495	0.024
	PowerPoint	15	3.2242	.83058		

The results of the independent sample t-test in the post-test for AS showed that the calculated t-values are significant at 0.05 level, suggesting that there is a development in attention skills in general and in all categories of attention skills among children with autism in Jordan due to the using of NLAL applications in iPad and in PowerPoint presentations (the AS of the children, including all its categories, was developed through the use of NLAL applications on the iPad and PowerPoint presentations). The differences in the iPad group were increased more than that in the PowerPoint group.

To answer research question two, "Is there a difference in the development in attention skills, (orienting attention, sustaining attention, shifting attention, and joint attention) among children with autism in Jordan based on their age due to the using of NLAL applications in iPad and in PowerPoint presentations?", the teachers applied the AS test to the two groups (iPad and PowerPoint groups). The researcher divided the age of children into three categories: less than 6 years (11 children), 6–9 years (11 children), and more than 9 years (8 children). The researcher used gain score and one-way ANOVA.

Table 7: Numbers of children in each group based on their age

Group	Age Range Levels			Total
	less than 6 years	6-9 years	more than 9 years	
iPad	6	5	4	15
PowerPoint	5	6	4	15
Total	11	11	8	30

Table 8: Gain Score Results for the Respondents in the Test of Attention Skill

Category	N	Minimum	Maximum	Mean	Std. Deviation
1	30	-.38	2.38	1.6917	.76122
2	30	-.27	2.45	1.7212	.74352
3	30	-.29	2.43	1.8000	.74807
4	30	-.14	2.43	1.8095	.76273
Total	30	-.18	2.27	1.7495	.73769
Valid N (list wise)	30				

The results showed positive gain scores for each variable, suggesting that the post-test score was greater than the pre-test score.

Table 9: Gain Score Results for iPad Group and PowerPoint Group

Group		1	2	3	4	Total
iPad	Mean	1.8583	1.9394	2.0667	2.0476	1.9697
	N	15	15	15	15	15
	Std. Deviation	.22093	.27844	.20107	.25133	.19672
PowerPoint	Mean	1.5250	1.5030	1.5333	1.5714	1.5293
	N	15	15	15	15	15
	Std. Deviation	1.04497	.98265	.98304	1.01015	.99229
Total	Mean	1.6917	1.7212	1.8000	1.8095	1.7495
	N	30	30	30	30	30
	Std. Deviation	.76122	.74352	.74807	.76273	.73769

Similar to the results cited in the preceding paragraph, positive gain scores were observed for each variable for each group. Hence, the post-test score was greater than the pre-test score. The results of the iPad group showed that shifting attention had the highest mean, followed by joint attention, AS in general, sustaining attention, and orienting attention. The results of the PowerPoint group showed that joint attention had the highest mean, followed by shifting attention, AS in general, orienting attention, and sustaining attention.

Table 10: One-way ANOVA results for Posttest of iPad Group

		Sum of Squares	df	Mean Square	F	Sig.
1	Between Groups	.075	2	.038	.977	.405
	Within Groups	.462	12	.039		
	Total	.538	14			
2	Between Groups	.400	2	.200	1.717	.221
	Within Groups	1.399	12	.117		
	Total	1.799	14			
3	Between Groups	.090	2	.045	1.424	.279
	Within Groups	.378	12	.032		
	Total	.468	14			
4	Between Groups	.046	2	.023	1.020	.390
	Within Groups	.272	12	.023		
	Total	.318	14			
Total	Between Groups	.107	2	.053	1.296	.309
	Within Groups	.494	12	.041		
	Total	.600	14			

Refer to Table 10 the F values were not significant at 0.05 level for each variable, that means there is no difference in the development of attention skills, and in the four categories of attention skills among children with autism in Jordan based on their age for iPad group (the AS development of the children in the iPad group did not significantly vary).

Table 11: One-way ANOVA results for Posttest of PowerPoint Group

		Sum of Squares	df	Mean Square	F	Sig.
1	Between Groups	.626	2	.313	.473	.634
	Within Groups	7.930	12	.661		
	Total	8.556	14			
2	Between Groups	1.235	2	.618	.915	.427
	Within Groups	8.100	12	.675		
	Total	9.336	14			
3	Between Groups	1.710	2	.855	1.197	.336
	Within Groups	8.570	12	.714		
	Total	10.280	14			

4	Between Groups	.956	2	.478	.514	.611
	Within Groups	11.161	12	.930		
	Total	12.117	14			
Total	Between Groups	1.090	2	.545	.763	.488
	Within Groups	8.568	12	.714		
	Total	9.658	14			

Refer to Table 11 the F values are not significant at 0.05 level for each variable, that means there is no difference in the development of attention skills, and in the four categories of attention skills among children with autism children in Jordan based on their age for PowerPoint group (the development of AS, including its categories, did not significantly vary among this group).

To answer research question three, "Is there a relationship between the development of attention skills, (orienting attention, sustaining attention, shifting attention, and joint attention) among children with autism in Jordan and their age group due to the using of NLAL applications in iPad and in PowerPoint presentations the teachers applied the AS test for the iPad and PowerPoint groups that involved children aged between 3 and 13 years.

Table 12: Partial Correlation; results of the relationship between the development of attention skills and their age group

Control Variables			iPad	PowerPoint	Age
iPod		Correlation	1.000	.859	.771
		Significance (2-tailed)	.	.000	.001
		df	0	13	13
-none ^a	PowerPoint	Correlation	.859	1.000	.849
		Significance (2-tailed)	.000	.	.000
		df	13	0	13
Age		Correlation	.771	.849	1.000
		Significance (2-tailed)	.001	.000	.
		df	13	13	0
Age	iPod	Correlation	1.000	.607	
		Significance (2-tailed)	.	.021	
		df	0	12	
PowerPoint	Correlation	.607	1.000		
	Significance (2-tailed)	.021	.		
	df	12	0		

a. Cells contain zero-order (Pearson) correlations

The post-test result for the AS in general of the sample children showed that $r = 0.859$ was significant at 0.05 level ($p = .000$) through the use of NLAL applications on the iPad and PowerPoint presentations. This value reduced to $r = 0.607$, which was also significant at 0.05 level ($p = .021$). Thus, age positively affected the relationship between the development in attention skills among children with autism in Jordan and their age group due to the using of NLAL applications in iPad and in PowerPoint presentations.

Table 4.11: Partial Correlation; results of the relationship between the development of orienting attention and their age group

Control Variables			iPad	PowerPoint	Age
iPod		Correlation	1.000	.866	.711
		Significance (2-tailed)	.	.000	.003
		df	0	13	13
-none ^a	PowerPoint	Correlation	.866	1.000	.833
		Significance (2-tailed)	.000	.	.000
		df	13	0	13
Age		Correlation	.711	.833	1.000
		Significance (2-tailed)	.003	.000	.
		df	13	13	0
Age	iPod	Correlation	1.000	.702	
		Significance (2-tailed)	.	.005	
		df	0	12	
PowerPoint	Correlation	.702	1.000		
	Significance (2-tailed)	.005	.		
	df	12	0		

a. Cells contain zero-order (Pearson) correlations.

For orienting attention, which was the first domain of the AS test, the result of the post-test showed that $r = 0.866$ was significant at 0.05 level ($p = .000$) through the use of NLAL applications on the iPad and PowerPoint presentations. This value reduced to $r = 0.702$, which was also significant at 0.05 level ($p = .005$). Hence, age positively influenced the relationship between the development in orienting attention among children with autism in Jordan and their age group due to the using of NLAL applications in iPad and in PowerPoint presentations.

Table 4.12: Partial Correlation; results of the relationship between the development of sustaining attention and their age group

Control Variables			iPad	PowerPoint	Age
-none ^a	iPad	Correlation	1.000	.783	.705
		Significance (2-tailed)	.	.001	.003
		df	0	13	13
	PowerPoint	Correlation	.783	1.000	.843
		Significance (2-tailed)	.001	.	.000
		df	13	0	13
Age	Correlation	.705	.843	1.000	
	Significance (2-tailed)	.003	.000	.	
	df	13	13	0	
Age	iPad	Correlation	1.000	.494	
		Significance (2-tailed)	.	.073	
		df	0	12	
	PowerPoint	Correlation	.494	1.000	
		Significance (2-tailed)	.073	.	
		df	12	0	

a. Cells contain zero-order (Pearson) correlations.

Regarding sustaining attention, the result of the post-test showed that $r = 0.783$ was significant at 0.05 level ($p = .001$) through the use of NLAL applications on the iPad and PowerPoint presentations. This value reduced to $r = 0.494$, which was not significant at 0.05 level ($p = .073$). Thus, age positively affected the relationship between the development in sustaining attention among children with autism in Jordan and their age group due to the using of NLAL applications in iPad and in PowerPoint presentations.

Table 4.13: Partial Correlation; results of the relationship between the development of shifting attention and their age group

Control Variables			iPad	PowerPoint	Age
-none ^a	iPad	Correlation	1.000	.613	.561
		Significance (2-tailed)	.	.015	.030
		df	0	13	13
	PowerPoint	Correlation	.613	1.000	.816
		Significance (2-tailed)	.015	.	.000
		df	13	0	13
Age	Correlation	.561	.816	1.000	
	Significance (2-tailed)	.030	.000	.	
	df	13	13	0	
Age	iPad	Correlation	1.000	.324	
		Significance (2-tailed)	.	.258	
		df	0	12	
	PowerPoint	Correlation	.324	1.000	
		Significance (2-tailed)	.258	.	
		df	12	0	

a. Cells contain zero-order (Pearson) correlations.

Regarding shifting attention, the result of the post-test indicated that $r = 0.613$ was significant at 0.05 level ($p = .015$) through the use of NLAL applications on the iPad and PowerPoint presentations. This value reduced to $r = 0.324$, which was not significant at 0.05 level ($p = .258$). Thus, age positively affected the relationship between the development in shifting attention among children with autism in Jordan and their age group due to the using of NLAL applications in iPad and in PowerPoint presentations.

Table 4.14: Partial Correlation; results of the relationship between the development of joint attention and their age group

Control Variables			iPad	PowerPoint	Age
-none ^a	iPad	Correlation	1.000	.594	.619
		Significance (2-tailed)	.	.019	.014
		df	0	13	13
	PowerPoint	Correlation	.594	1.000	.860
		Significance (2-tailed)	.019	.	.000
		df	13	0	13
Age	Correlation	.619	.860	1.000	
	Significance (2-tailed)	.014	.000	.	
	df	13	13	0	
Age	iPad	Correlation	1.000	.155	
		Significance (2-tailed)	.	.598	
		df	0	12	
	PowerPoint	Correlation	.155	1.000	
		Significance (2-tailed)	.598	.	
		df	12	0	

a. Cells contain zero-order (Pearson) correlations.

Joint attention was the fourth domain of the AS test. The result of the post-test for this variable showed that $r = 0.594$ was significant at 0.05 level ($p = .019$) through the use of NLAL applications on the iPad and PowerPoint presentations. This value reduced to $r = 0.155$, which was not significant at 0.05 level ($p = .598$). Thus, age positively affected the relationship between the development in joint attention among children with autism in Jordan and their age group due to the using of NLAL applications in iPad and in PowerPoint presentations.

Discussion:

The findings shows that the calculated t-value was significant at 0.05 level for each variable of the AS. The differences in the AS of the children in the iPad sample (experimental group G1) were more evident than those in the children in the PowerPoint sample (control group G2). Thus, the development in AS (orienting, sustaining, shifting, and joint attention) of the sample children through the use of NLAL applications on the iPad and PowerPoint presentations significantly varied. That means there is a development in attention skills, (orienting attention, sustaining attention, shifting attention, and joint attention) among children with autism in Jordan due to the using of NLAL applications in iPad and in PowerPoint presentations.

This finding conforms to the conclusions drawn by other studies regarding the effect of using AT, including computer, computer software (i.e., PowerPoint presentations), tablet computers, and the iPad, on the improvement of many skills of children with ASD, including their AS and other skills (Aronin & Floyd, 2013; Beaumont & Sofronoff, 2008; Blood, Johnson, Ridenour, Simmons & Crouch, 2011; Coleman, 2009; Conn, 2012; Douglas, Wojcik & Thompson, 2012; Giannopulu & Pradel, 2010; Gulchak, 2008; Kay, 2012; Malley, Lewis & Donehower, 2013; Price, Howard & Winslow, 2011; Rahman, Ferdous, Ahmed & Anwar, 2011; Saylor & Rodriguez-Gil, 2012; Shah, 2011; Siegle, 2013; Staley, 2012; Stromer, Kimball, Kinney & Taylor, 2006; Tanaka *et al.*, 2010; Wu *et al.*, 2007).

The differences in the AS development of children were significantly observed more in the iPad sample (experimental group G1) than in the PowerPoint sample (control group G2). This observation is compatible with Durkin's (2010) statement that children with ASD are attracted to computers, particularly to the iPad, because of its touch screen feature and the availability of a number of low-cost and free apps. Huang, Clark, and Wedel (2013), McClanahan, Williams, Kennedy, and Tate (2012), and Sahin and Cimen (2011) also determined that the attention span of students is long when they interact with iPad applications. Pelangka (2011) identified that after four weeks of study, the research participants gained the ability to sustain attention to an independent task and was increased throughout the study and during follow-ups.

The AS (including orienting, sustaining, shifting, and joint attention) of the sample children in both groups was improved. However, this development differed according to the group and the categories of AS. For the iPad group, shifting attention had the highest mean (mean = 2.0667), followed by joint attention (mean = 2.0476), AS in general (mean = 1.9697), sustaining attention (mean = 1.9394), and orienting attention (mean = 1.8583). For the PowerPoint group, joint attention had the highest mean (mean = 1.5714), followed by shifting attention (mean = 1.5333), AS in general (mean = 1.5293), orienting attention (mean = 1.5250), and sustaining attention (mean = 1.5030). Thus, the use of iPad applications and PowerPoint presentations incurred different effects on all categories of AS and on AS in general in varying proportions.

The results of the study on the age of the children as a variable and one-way ANOVA show that the F values in Tables 4.8 and 4.9 were not significant at 0.05 level for each variable (AS and orienting, sustaining, shifting, and joint attention) for the two groups. Thus, there is no difference in the development in attention skills (orienting attention, sustaining attention, shifting attention, and joint attention) among children with autism in Jordan based on their age due to the using of NLAL applications in iPad and in PowerPoint presentations.

The results cited in the preceding paragraph correspond with the findings obtained by Flores, Faciane, Edwards, Tapley, and Dowling (2014). These researchers used AT with different categories of respondents' age with children aged 3 and 11 years. O'Malley *et al.* (2013) examined the case of students with autism aged 12 and 15 years. Fan (2012) investigated the case of children with autism aged 9 and 11 years. Plavnick (2012) looked into the condition of children with autism aged 4 years, and Pelangka (2011) analyzed the case of children with autism aged 3, 5, and 15 years. All these researchers significantly proved the effective of use of different types of AT with different categories of age.

In general, the quantitative data confirmed the importance of using visual supports on children with autism because of their high visual abilities. Visual ability supports (e.g., AT devices) that can be used to support the processing modality of students can also be used widely to enable the learning of children with autism (Aliee, Jomhari, Rezaei, & Alias, 2013; Fan, 2012; Lindsey-Glenn & Gentry, 2008; Narkon, Wells, & Segal, 2011).

Conclusion:

The results of this study show that the use of NLAL in iPad applications and PowerPoint presentations improved the AS in general and also orienting, sustaining, shifting, and joint attention of the children with autism in Jordan. Also the differences in the AS of the children in the iPad sample were more evident than those in the children in the PowerPoint sample. Thus, the development in AS (orienting, sustaining, shifting, and joint

attention) of the sample children through the use of NLAL applications on the iPad and PowerPoint presentations significantly varied. In addition, the researcher recommended using the iPad applications and PowerPoint presentations with a computer at schools and centers for children with autism as a teaching tool to increase the AS of the students. These types of AT can effectively improve the communication skills, learning ability, and independence of the children. Finally, additional applications should be developed in the Arabic language and include all fields in growth and learning, such as language, motor, cognitive, and academic skills.

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Appendix A:

Test of Attention skills:

Name Age

Gender male / female Date

Pretest / posttest iPad / PowerPoint

Form Completed by

Total mark

Instructions

The checklist of attention skills is a list of four categories of attention skills. Orienting Attention, Sustaining Attention, Shifting Attention, and Joint Attention. Every category has some items related. The examiner has to checking the presence or absence of adjectives in every category by using rating scale starts from 1 to 4. 1 mean

that the child never show the feature, 2 mean that the child sometimes show the feature, 3 mean that the child often show the feature, 4 mean that the child always show the feature.

	Domains	Never 1	Sometimes 2	Often 3	Always 4
1) Orienting Attention					
1	Child turns head or shift gaze toward a stimulus				
2	Child can respond to his name				
3	Child have the ability to orient his attention to stimuli				
4	Child can orient his attention to people when they enter the place				
5	Child seem listen to auditory stimuli or particular sounds				
6	Child seem excited in the beginning of the training or any task				
7	Child seem interested to visual stimuli or stimuli object such as mirror, light, and fan				
8	Child able to focus on a particular stimuli while ignoring other stimuli				
Total					
2) Sustaining Attention					
1	Child keeps his eye contact to objects for enough time				
2	Child able to work independently until completed his task				
3	Child able to finish the task required with limited help				
4	Child likes tasks that requiring sustained attention				
5	Child remains attentive while doing his task				
6	Child is able to wait for his turn in any play or work (turn taking)				
7	Child seems harmonious / interactive while task or play activities				
8	Child don't give up from the task until he finished				
9	Child able to show appropriate level of sustained attention during the conversation with him				
10	Child shows enough level of sustained attention when he is given visual or auditory stimulus				
11	While the child engage in the task, his attention don't distracted to other stimuli				
Total					
3) Shifting Attention					
1	Child can disengage attention from one stimulus and shift attention to a new stimulus, even if he didn't finish the task of the first stimulus successfully				
2	Child able to follow the instructions and directions that require sequential steps (more than one step)				
3	Child switch easily from one activity to another at a time				
4	Child seem organized when he shifting his attention between stimulus				
5	Child can keep his attention while task changes (for example when the pictures / slides changes)				
6	Child can wrap up the final details of his task before start another task				
7	Child can pay attention to details appears in any task when the tasks changes				
Total					
4) Joint Attention					
1	Child able to turn his head in the same direction as the peers do to auditory or visual stimulus during training				
2	Child able to shift gaze in the same direction as the peers do to auditory or visual stimulus during training				
3	Child able to gaze carefully / with interest toward the stimulus as the others doing when he is in group				
4	Child have the ability to alternate gaze between an objects and people				

5	Child can follow eye gaze and pointing of the peers				
6	Child can follow the instructions from the peers when he is in group				
7	Child able to lead another person's attention to objects or events for the purpose of sharing experiences				
Total					